Using Grounded Theory to inform the Design of Energy Interventions for the Workplace

Derek Foster, Shaun Lawson, Joss Winn
University of Lincoln
{defoster, slawson, jwinn} @lincoln.ac.uk

Howard Noble, Dave White
University of Oxford
howard.noble@oucs.ox.ac.uk,
david.white@conted.ox.ac.uk

ABSTRACT
Much work has been published on using technological interventions to motivate reductions in home energy consumption. These interventions have produced promising results, but typically focus on emphasising the financial benefits of reductions in consumption to users. Motivating employees to reduce their consumption of energy in the workplace is more problematic, as they are typically not responsible for energy costs. There has been very little work to date addressing energy interventions in the workplace, and indeed, there are many challenges in doing so.

This paper presents an overview of the initial user-centred design stage of a large energy research project called *Electro-Magnates*. Three day-long workshops were run with a total of 65 participants from 5 universities and a number of representatives from industry. The workshops' main focus was understanding behaviour change in organisations in an energy resource and usage context, supported by designing a 12 month intervention. Audio and design task accounts were transcribed and analysed using the grounded theory approach with the developed theory forming the design requirements and implications for the Electro-Magnates intervention software. Our findings identified some of the key concepts for inclusion in a workplace energy intervention; incentivisation, openness and management buy-in.

Categories and Subject Descriptors
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design, Human Factors

Keywords
Energy, sustainability, behaviour change, HCI, persuasive technologies, organisations

1. INTRODUCTION
The HCI community has recently shown a great deal of interest in the development of interactive systems that facilitate behaviour change for sustainability, collectively known as 'Persuasive Technologies', a term coined by Fogg [3]. Much of this research has exploited ideas recently re-popularized by Thaler and Sunstein [7] in that individuals can be 'nudged' to make better lifestyle decisions, given the right information and the environment in which to do so. Much of this work has focused on how individuals might improve their own private and domestic lifestyle, behaviour, and sustainable resource consumption. however, such work has rarely taken account of the fact that people spend a significant amount of their waking hours at work where they also contribute towards resource consumption. With large public and private sector organisations accounting for 10% of the UK's emissions [2] there is scope for reductions through motivating employees to modify their behaviour.

In our previous work [4] we motivated participants to reduce their domestic energy consumption through a synergy of energy data feedback and social media. However, designing a similar system for the workplace presents greater challenges across a range of design, ethical and technical issues. From our earlier study focus groups in the domestic environment we discovered that for most people *cost* was the primary motivating reason to reduce their energy use, a finding also present in a home energy study by Chetty *et al* [1]. In essence a decrease in cost is the *reward* for reducing consumption. In the workplace employees are typically not responsible for paying energy costs creating a problem in how to incentivise positive behaviours.

This paper provides an overview analysis, using the Grounded Theory (GT) method [6], of a series of organisational energy workshops investigating perceptions and behaviours of energy usage, as well as both positive and negative implications for intervention design. The work forms the initial user-centred design component of the HEFCE funded Electro-Magnates project [5], an endeavour which aims to reduce energy consumption in the workplace by utilising a suite of social persuasive applications to encourage positive consumption behaviours. Personal desktop widgets and situated displays will be used to deliver energy feedback to individuals, groups and communities about their own – and others' – energy usage, to foster exchange of performance and to support constructive competition to reduce consumption. The workplace in the context of this study is educational and public sector work-place environments in the county of Lincolnshire, UK.

2. WORKSHOPS AND FOCUS GROUPS
Understanding energy usage in the workplace is a complex task with strong ethical and social issues that cannot be easily quantified. In order to address the problem of adequately understanding employee motivations, engagement and incentivisation in workplace energy interventions; we ran a series of workshops. These workshops were run across different organisations with a total of 65 participants taking part from five

Conference'10, Month 1–2, 2010, City, State, Country.

universities and businesses in the energy industry. The job roles of participants covered a diverse range including administration, librarians, IT support and institutional leaders. During the workshop participants were asked to complete a survey requiring both quantitative and qualitative responses, and also to themselves design a 12 month energy intervention for the workplace. This design task was carried out by participants in small groups. Survey results were not included in this current work due to space constraints. The focus of this work is the GT analysis of both the substantial written and audio accounts of the design task process.

3. GROUNDED THEORY

3.1 Open Coding

The first phase of the GT is open coding which includes manually trawling for conceptual labels (codes) relating to energy usage from the corpus of design task data. A total of 631 codes were compared and grouped into 36 abstract categories. Concept granularity was at the word or sentence level with examples coded such as 'hide the overall problem with metrics', 'senior management' and 'rewards'. Further refining of the codes into key categories is carried out in the next step.

3.2 Axial and Selective Coding

Abstract categories from open coding were amalgamated to create a stronger hierarchy forming key related categories. The resultant axial categories are the central themes on which the energy intervention design theory is developed. From these a 'core' category is developed using selective coding that integrates and connects to all others. Six key axial categories were identified:

Incentives

This comprises the question 'What's in it for me?' Employees want to be incentivised by rewards that they can negotiate. This involves selecting the intrinsic 'value' of savings, some examples given were a pot for student bursaries or free Xmas party.

Openness

Placing trust in their organisation, and accepting the reasons why they are attempting to make savings with an absence of cynicism in what will be done with any savings was crucial for employee engagement with energy interventions. Having confidence the organisation is acting in the employee's best interest.

Engagement

Competition and negotiated targets were favoured to engage with an intervention; with particular emphasis on negotiated targets being *achievable.* Unrealistic targets, inability to set targets and unfair competition were highly cited for bringing about potential disengagement.

Communication

This was seen as critical at all stages of an intervention. Communication encompassed workshops for educating employees on energy as a finite resource to effective marketing campaigns for recruitment, along the lines of selling the idea of a green intervention as a product. Lines of communication should be open up and down in an organisation with quality of the message, not the mode of communication, the important factor.

Visualisation

Representation was the most debated theme to emerge. The overarching finding was there is no 'silver bullet' or 'one size fits all' method. Instead, having a choice of visualisations that embed the attributes of the other five key categories in the GT would be the most engaging. Granularity of energy data was considered important with the office or department level preferred. Comparison feedback was favoured but only when presented fairly, i.e. like for like or compared to self.

Management Buy-In

Senior management buy-in was a thread woven throughout most of the data analysed. Without this buy-in, employees felt disempowered and frustrated that their efforts would be trivial with interventions destined to fizzle out. Charismatic leadership and leading change from the top were cited as being the most motivating factors in employees engaging with and adhering to an intervention, with change trickling down the organisation.

The selected core category was 'Corporate Responsibility', a theme that integrates and links our key categories and generates the developed theory's whole story. Corporate responsibility promotes trust, ethical values and transparency in an organisations activities and acts as the main driver for key categories identified in the GT such as openness, communication and management buy-in. It encompasses the whole organisational structure from top to bottom conveying the message that all levels of staff have to engage to realise a positive impact when deploying interventions. The emergent theory is also essentially a research hypothesis that raises questions for design implications in workplace energy interventions. In the Electro-Magnates project the theory would be used to both inform and investigate the efficacy of the generated design implications and concepts.

CONCLUSIONS AND FUTURE WORK

This work has demonstrated the value of the GT method to inform the design process of workplace energy interventions. It provides a rich account of employee and management perspectives of current energy usage practices and how to design effective interventions. The next step is to apply these findings to the interactive software design of our funded research project - Electro-Magnates - and the rolling out of our large scale energy studies across campus and local authority infrastructure.

4. REFERENCES

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